Abstract

The GEWEX/CLIVAR Global Land-Atmosphere Coupling Experiment (GLACE) has provided an estimate of the global distribution of land-atmosphere coupling strength during boreal summer based on the results from a dozen weather and climate models. However, there is a great deal of variation among models, attributable to a range of sensitivities in the simulation of both the terrestrial and atmospheric branches of the hydrologic cycle. It remains an open question whether any of the models, or the multi-model estimate, reflect the actual pattern and strength of land-atmosphere coupling in the earth's hydrologic cycle. We attempt to diagnose this by examining the local co-variability of key atmospheric and land surface variables both in models and in those few locations where comparable, relatively complete, long term measurements exist. We find that most models do not encompass well the observed relationships between surface and atmospheric state variables and fluxes, suggesting that these models do not represent land-atmosphere coupling correctly. Specifically, there is evidence that systematic biases in near surface temperature and humidity among all models may lead to incorrect surface flux sensitivities. However, the multi-model mean generally validates better than most or all of the individual models. We also compare regional precipitation behavior (lagged autocorrelation and predisposition toward maintenance of extremes) between models and observations. Again we find a great deal of variation among the participating models, but remarkably accurate behavior of the multi-model mean.